UNCLASSIFIED SOVIET BLOC INTERNATIONAL GEOPHYSICAL YEAR INFORMATION

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This report presents unevaluated information on Soviet-Bloc activities in the International Geophysical Cooperation program from foreign-language publications as indicated in parentheses. It is published as an aid to United States Government research.

INTERNATIONAL GEOPHYSICAL COOPERATION PROGRAM
SOVIET-BLOC ACTIVITIES

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I. GENERAL

Ukrainian Participation in the IGC

Investigations in the fields of terrestrial magnetism and electricity, oceanology, meteorology, aurora, meteor astronomy, solar activity, time service and systematic observations of artificial satellite movements are being conducted at 18 scientific establishments located throughout the territory of the Ukraine. The scope, achievements, and objectives of these Ukrainian activities are well summarized in a Ukrainian magazine article by B. G. Bondarchuk, an Academician at the Academy of Sciences Ukrainian SSR and chief of the Organizational Committee of the Academy of Sciences Ukrainian SSR for the IGY.

Work of particular importance in the IGY program is being conducted by such organizations as the Main Astronomical and Poltava Gravimetric observatories, the Institute of Geological Sciences and the Institute of the Geology of Useful Minerals of the Academy of Sciences Ukrainian SSR, the Hydrometeorological Services Administration of the Ukrainian SSR, the Kiev State University imeni T. G. Shevchenko, the Astronomical Observatories of Khar'kov, L'vov and Odessa state universities, Khar'kov Politechnic Institute imeni V. I. Lenin, the Khar'kov State Institute of Standards and Measuring Instruments, and a number of other establishments.

Coordination of operations at these organizations for the IGY program is maintained by the Organizational Committee of the Academy of Sciences Ukrainian SSR.

Considerable preparatory work was done by the Ukrainian participants to insure successful execution of assignments for the IGY program. Existing observatories were equipped with new instruments. In the vicinity of Kiev, a magnetic station was built for the Institute of Geological Sciences of the Academy of Sciences Ukrainian SSR for the study of the geomagnetic field of the Earth. Special stations for observation of the pulsations of electric Earth currents were constructed by the Institute of the Geology of Useful Minerals, Academy of Sciences Ukrainian SSR at Koretz, Morshin, and Uzhgorod. All observatories and certain locations near Kiev, Khar'kov, and Odessa were equipped with stations for visual, photographic, and radio observations of meteors and artificial satellites.

Great effort was made by Ukrainian scientists to perfect techniques for geophysical observations. As an example, the collective of scientific workers at the Khar'kov Politechnic Institute imeni V. I. Lenin developed an original apparatus for the study of meteors and the upper layers of the atmosphere by a radar method. Through the use of this equipment, new facts were obtained about the movement of meteorites. It was established that a

predominate number of these bodies move in a straight line and have orbits near to the plane of the ecliptic. Workers of this institute also constructed new equipment and began observations of winds at altitudes of 80 to 100 kilometers for the first time in the Soviet Union.

The new "meteor patrol" apparatus for automatic photographing of meteors was developed at the Astronomical Observatory of Odessa State University imeni I. I. Mechnikov and is being widely utilized in observatories of the Soviet Union and the People's Democracies.

A new molecular clock, distinguished by its accuracy and stability, was developed at the Khar'kov State Institute of Standards and Measuring Instruments. Data from observations utilizing this instrument are being widely used by the Time Service of the Soviet Union.

Operations of the Astronomical Observatory of Khar'kov State University imeni Gor'kiy and the Khar'kov Institute of Standards and Measuring Instruments on the problem of determining time and longitude are greatly facilitated by the best quartz clock in the Soviet Union. Interesting information on the irregular movement of the Earth about its axis was obtained by the observatory with this instrument.

A new chromospheric-photospheric telescope was installed at the Main Astronomical Observatory of the Academy of Sciences Ukrainian SSR, permitting more accurate astronomical observations. Workers at this observatory have also developed a new method for determining coordinates of artificial satellites.

Prediction of the exact position of a satellite at any given time is possible by an original method developed by workers at the Astronomical Observatory of L'vov State University imeni Ivan Frank. The new instrument employed for this method was built at the Astronomical Observatory of the Kiev State University. Considerably more accurate satellite observations and less calculation time are possible with the new method.

Important work in the IGY program is being performed by the Poltava Gravimetric Observatory of the Academy of Sciences Ukrainian SSR. This organization is the all-union center of the latitude service and the main scientific establishment of the IGY and is concerned with the problem of variations of latitude and pole displacements. This observatory is united with stations in Pulkovo, Moscow, Kazan', Kitab, Irkutsk, and Blagoveshchensk, from which material on latitude observations is relayed to Poltava for processing and generalization. New methods have also been developed here for the determination of polar coordinates from data on azimuth observations.

The task of collection and publication of data gathered from 22 zenith telescopes in 16 observatories throughout the world was assigned to the Poltava Observatory at the Tenth Congress of the International Astronomical Society. Preparations are now being made for the organization of a special laboratory to function as a permanent world center for processing latitude observations.

The Crimean Astrophysical Observatory serves as the international center and the main institution of the Soviet Union in the study of the problem of investigation of solar activity. From the scientific and equipment aspects, the observatory is one of the best in the world. Unique equipment has been developed by this organization for study of the structure of the ionosphere and radio emissions from the Sun.

Studies of the Sun also maintain an important position in the IGY program. Particular attention is given to the study of chromospheric flares which are associated with such natural phenomena as geomagnetic and ionospheric storms, aurora, and the intensity of corpuscular, and X-ray and ultraviolet radiation.

Observatories of the Ukrainian SSR, which are performing studies of the Sun, had accumulated valuable material during the regular IGY. At the Astronomical Observatory of Kiev State University alone, over 650 groups of sunspots and 54 chromosphere flares were registered in 1958. Spectrograms of the chromosphere flares and prominences, etc. were also obtained. These investigations produced new data on the structure of the hydrogen and calcium atmosphere of the Sun, the nature of the asymmetry in the equatorial maximums of geomagnetic storms, pecularities in the structure of the chromosphere, etc.

Important investigations on the problem of auroras are being conducted by the Chair of Astronomy of Kiev State University. Basic observations are being conducted at a station on the Bay of Tiksi, which was constructed for this purpose. This station is equipped with instruments of native construction which are of a precision unequaled in foreign observatories. Results of these investigations have produced new data concerning the structure, development, and distribution of auroras, corpuscular flows, etc.

Preliminary processing of magnetograms obtained at the Kiev Magnetic Station of the Institute of Geological Sciences of the Academy of Sciences Ukrainian SSR give evidence of the true concurrence of magnetic storms and aurora observed at Ukrainian meteorological stations in 1958.

The main center for the study of meteors is the Astronomical Observatory of Odessa State University. New meteor observation stations were constructed in the villages of Mayaki and Krizhanovka and also in the Odessa Botanical Garden. The special "meteor patrol" considerably improves the precision of meteor observations.

Activities in meteorology, astronomy, and oceanography are being conducted by the Hydrometeorological Service Administration of the Ukrainian SSR and the Ukrainian Scientific Research Hydrometeorological Institute. Similar operations are being conducted on 16 mainland stations and about ten stations on ships.

Certain regularities as to the distribution of the electric field in the atmosphere of the Earth in relation to meteorological conditions and altitude were established from results of investigations. It was discovered that at an altitude of 500 meters, the maximum factor of the electric field strength is connected with certain pecularities in the circulation of the atmosphere which effect the variation of climate over the Ukraine. The first results were also obtained for the heat balance over the territory of the Ukraine.

Oceanological observations are being performed principally by the Hydrometeorological Observatory of the Black and Azov Seas of the Hydrometeorological Service of the Ukrainian SSR. These observations are supplemented by approximately 65 maritime hydrometeorological stations and posts dispersed along the coast line and also on ships of the Azov-Black Sea Fleet. From the results of observations for the IGY program, it was possible to construct a map of the distribution of hydrological and hydrochemical elements at various depths of the Black Sea, a dynamic chart of currents, and to obtain improvement of the bottom relief map for the Black Sea.

Investigations throughout the course of IGC will be conducted at the level attained in 1958. Particular attention will be paid to the processing of collected facts and observational data and further improvement in the accuracy of observations.

(Additional information on Ukrainian participation in the IGC is presented in the form of a map sketch and photograph. The map shows the location of points where observations are being conducted according to the IGY program in the territory of the Ukrainian SSR. The photograph shows the expeditionary vessel Gorizont of the Hydrometeorological Service of the Ukrainian SSR.) ("International Geophysical Cooperation," by V. G. Bondarchuk, Academician, Academy of Sciences Ukrainian SSR, and chairman of the Organizational Committee for the IGY of the Academy of Sciences Ukrainian SSR; Kiev, Nauka i Zhytta, No 2, Feb 59, pp 21-24)

Conference of Young Scientists-Geologists

A conference of young scientists-geologists of the Transcaucasian republics was held in Yerevan from 28 October to 10 November 1958. The conference was called by the Institute of Geological Sciences of the Academy of Sciences Armenian SSR. A delegation from the Institute of Geology of the Academy of Sciences Turkmen SSR composed of S. Amanov and K. Tegelekov, aspirants, took part in the work of the conference.

Many reports on problems of stratigraphy and tectonics, petroleum and gas geology, magnetism and vulcanology, mineralogy and geochemistry, hydrogeology, and mine structures were read and discussed.

A resolution establishing yearly meetings for young scientists-geologists was accepted by the participants in the conference. ("Conference of Young Scientists-Geologists," by S. Amanov, Institute of Geology, Academy of Sciences, Turkmen SSR; Ashkhabad, Izvestiya Akademii Nauk Turkmenskoy SSR, No 6, 1958, p 120)

II. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Nesmeyanov Speech on Soviet Cosmic Research at Annual Meeting of Academy of Sciences USSR

Academician A. N. Nesmeyanov, president of the Academy of Sciences USSR, generalized the investigations of Soviet scientists in the field of cosmic exploration by means of rockets and artificial earth satellites.

The speech, "The Investigation of Cosmic Space With the Aid of Rockets and Sputniks," was delivered at the closing session of the annual meeting of the Academy of Sciences USSR.

After describing the first Soviet artificial earth satellites, Nesmeyanov said that it was important to note that the launching of the rocket toward the Moon from Soviet territory was more difficult than a launching from lower latitudes. Soviet territory cannot intersect with the plane of the Moon's orbit, which, at present, lies approximately between 18 N and 18 S. This eliminates the possibility of using trajectories lying in the plane of the lunar orbit and which are more advantageous for a flight in the region of the Moon.

In addition, not all days of the month are equally favorable for the launching of a rocket.

The most favorable location of the Moon in orbit for a launching from Soviet territory is when its inclination is at a minimum and consists of about 18 degrees. A considerable deviation from this condition leads to a very substantial loss in the weight of the payload. The day selected for the rocket flight near the moon was the one in which its position deviated least from the optimum.

The launching of artificial Earth satellites and the cosmic rocket made it possible to obtain results of fundamental scientific value on the investigation of the upper layers of the atmosphere and cosmic space.

Nesmeyanov dwelt only on those experiments on which processing has been completed at present to the greatest degree. The unique aureole around the Earth was successfully discovered for the first time with the aid of the Soviet cosmic rocket. This aureole, as present Soviet experiments show, is composed of electrons with energies of tens and hundreds of thousands electron volts. The aureole extends for a distance greater than 10 earth radii.

A sharp increase in X-radiation beginning at a geomagnetic latitude of about 55 degrees was discovered with the aid of instruments carried by Sputniks II and III. Thus, the permanently existing electron component of the Earth's corpuscular component was discovered. The energy of these electrons is about 100,000 electron volts. The results obtained by the cosmic rocket made it possible to establish that the newly discovered electron component and the aureole around the Earth are one and the same phenomenon.

In addition to the Zones of increased intensity existing in the polar regions near the Earth and at distances up to 10 earth radii, a second zone of high intensity exists which begins at an altitude of more than 1,000 kilometers.

Soviet scientists made a more detailed study of this second zone. It was shown that it begins at an altitude of about 600 kilometers in the Western Hemisphere, but it is considerably over 1,000 kilometers high in the Eastern Hemisphere. In addition, it was established that this region stretches from the equator up to latitudes of 45 degrees. An analysis of the composition of the radiation showed that the energy of particles in the second zone is considerably higher than in the first zone.

Powerful streams of particles possessing a very short path length were discovered by Soviet scientists with the aid of Sputnik III and the cosmic rocket. Certain hypotheses on the origin of this form of radiation were explained by Nesmeyanov. According to one of these theories, this radiation arises with the interaction of cosmic rays with the earth's atmosphere, as a result of which there arise, in particular, neutrons, decaying afterwards into electrons and protons. Another theory holds that these corpuscles are discharged from the Sun and are caught in the trap of the earth's magnetic field.

Finally says Nesmeyanov, it should be mentioned that if the products of atomic explosions get into the higher altitudes, they create intensive streams of charged particles there. Thus, atomic explosions can lead to the contamination of that part of the cosmos near the Earth.

Soviet physicists obtained valuable information in the composition of heavy nuclei in cosmic radiation. They showed that the stream of charged particles in cosmic radiation is extremely small.

Soviet scientists have made an enormous contribution to the study of the upper atmosphere. Data on the density, temperature, the concentration of electrons and positive ions and other parameters of the upper atmosphere in the region of altitudes of 225-1,000 kilometers were first obtained by them.

The earlier representations that the limit of the atmosphere reached up to 1,000 kilometers has been fully disproved by Soviet researchers. At present, it is possible to assert that this limit extends up to considerably higher altitudes.

With the aid of the cosmic rocket, the first experimental data on the density of interplanetary gas was obtained. The mass spectrometer investigations conducted with Sputnik III on the composition of particles in the upper atmosphere gave extremely valuable results.

Outstanding data on magnetic measurements were obtained by Soviet scientists. For the first time, the deep origin of the sources of the East Siberian magnetic anomalies were determined. The effects of ionospheric current systems causing perturbed variations of the Earth's magnetic field were discovered. The discovery of an exoatmospheric current system at a distance of 3-4 earth radii is a fundamental result in the field of magnetic measurements by the cosmic rocket.

Soviet biologists conducted a unique experiment with the dog Layka. This was the first experiment in the history of biology in which a highly organized creature remained for a long time in cosmic space.

Nesmeyanov concluded his speech by praising all who had a part in the launching of the artificial earth satellites and the cosmic rocket. ("Outstanding Contribution of Soviet Scientists in the Investigation of the Cosmos"; Moscow, Pravda, 29 Mar 59, p 3; "Investigation of Cosmic Space With the Aid of Rockets and Sputniks"; Moscow, Izvestiya, 29 Mar 59, p 2)

Rocket Displays at USSR Exhibition

The "Nauka" [Science] pavilion at the Exhibition of Achievements of the National Economy of the USSR, which closed 29 March, contained a section devoted to Soviet achievements in rocket technique.

Much material was devoted to the investigation of the upper atmosphere with the aid of rockets. Displayed in the science pavilion were models of the meteorological rocket MR-1 and the nose cones of A1 and A2 geophysical rockets. These rockets were used for measurements at altitudes up to 110-212 kilometers. The nose cone of the A3 rocket is interesting. With a load of 1,520 kilograms it reached a record height of 472 kilometers.

Along with the nose cones, the enormous parachutes which safely lowered both instruments and experimental animals were also shown. The complex system of three parachutes for the A3 rocket exceeds an area of 700 square meters.

Models of Sputniks I, II, and III and their scientific apparatus were also displayed. ("Closing the Exhibition Pavilions...," by A. Kondrat'yev, chief of the Department of Information and Printing of the Exhibition of the Achievements of the National Economy of the USSR; Moscow, Promyshlenno-Ekonomicheskaya Gazeta, 1 Apr 59, p 4)

Artist's Conception of Lunar Scientific Station

An artist's conception of a lunar scientific station appears in Tekhnika Molodezhi, a Soviet popular science magazine. The laboratory installation is shown built under a thick layer of rocks, where it is protected from meteorites and where the sharp changes in the temperature of the lunar day and night will not be felt.

The station is a cylindrical two-deck affair, the upper deck of which contains a laboratory, the point in which control of the varied activities of the scientific station is concentrated, the communications room, and living quarters. The lower deck contains storage facilities for oxygen, water, fuel, spare parts, and instruments.

An astronomical observatory, a radiotelescope, a battery of photo-elements feeding the station batteries, and a radio tower for Earth communication are shown on the surface of the Moon nearby. An electrically driven caterpillar tractor with mechanical arms is used for lunar explorations by the station personnel in space suits. A greenhouse serves as a supplementary source of food. A space rocket for travel to the Earth is shown in the background. ("Window into the Future"; Tekhnika Molodezhi, No 2, Feb 59, p 36)

III. UPPER ATMOSPHERE

Soviet Scientist Discusses Kozyrev's Discovery of Moon Volcano

N. A. Kozyrev's report on the observation of volcanic activity on the Moon and the launching of the Soviet cosmic rocket shortly thereafter raised the interest in that natural satellite of the Earth to heights never before reached. In answer to a request by two readers, an article by A. Dadayev, a review of which follows, on Kozurev's discovery was published in Sovetskaya Aviatsiya.

Recently, great reliance has been placed on direct methods of investigating the lunar surface with the aid of rockets. Moreover, it appears that not all ground-based means for studying the Moon have been used, in particular, the spectroscope. Perhaps this condition arose because it was considered that the lunar spectrum, so to speak, only reproduced the spectrum of the Sun.

Prof Kozyrev long maintained that the Moon must have its own radiation. In his works, a particular kind of radiation, the luminescent brightness of certain matter under the action of hard ultraviolet radiation from the Sun, is indicated.

Kozyrev's first results, obtained in 1955, supported his belief that luminescence of materials on the Moon actually exists. It was important to isolate this luminescence on the background of the sunlight reflected from the Moon. This was possible through the use of the spectrograph. The lunar crater Alphonsus was selected as a suitable object for observation.

An observational program in 1958 was conducted by Prof Kozyrev in the Crimean Astrophysical Observatory, using its 50-inch reflector with a spectrograph. No indications of luminescencent brightness were observed in a considerable number of spectrograms made, and it was only on 3 November at about 0400 hours, that the central peak of the crater appeared redder than usual. By 0600 hours, the central peak was very bright and shining. A spectrogram obtained at the time revealed an interesting phenomenon: in the blue part of the spectrum a luminescence appeared quite clearly over the central peak. A spectrogram made at 0630 hours showed the crater had returned to its normal state. The whole phenomenon lasted several hours. Obviously, in the beginning, an ejection of dust (volcanic ash) occurred, and then a large amount of gases were discharged. Rising to the surface, the gases, under the action of the Sun's radiation, decomposed into more simple molecules whose luminescence was observed. An approximate calculation of the quantity of gases discharged resulted in a figure of 100,000 cubic meters; the

molecules of gas had a velocity of 200 meters per second. Thus, the whole process was extremely violent, which is an indication of the occurrence of a volcanic eruption and not the slow emanation of gases from lunar fissures.

Something should be said on an intrinsic peculiarity of lunar volcanoes. Since their eruption occurs in the absence of atmosphere, then the volcanic flame rising as a result of the union of strongly heated products of the eruption with oxygen cannot be seen. The lunar volcano manifests itself only because of the fluorescent illumination of gases, erupted and decomposed into simple molecules. Inasmuch as the fluorescence there occurs under the action of the sun's rays, it is impossible to observe the eruption of volcanoes at night on the side of the Moon not illuminated by the Sun. That is why eruptions on the Moon were not observed before, although they may possibly not be a rarity.

The reason volcanism on the Moon is possible is the same as that for it on the Earth, says Dadayev. At present, we think that molten magma is formed in specific foci deep under the Earth's surface as a result of the accumulation of heat from the decay there of radioactive elements. The extremely low thermal conductivity of the surface layers must undoubtedly contribute to the build-up of heat.

It should be mentioned, says Dadayev, that apparatus for studying the Moon's radioactivity was carried by the first Soviet cosmic rocket. ("How the Volcano on the Moon Was Discovered," by A Dadayev, Candidate of Physicomathematical Sciences; Moscow, Sovetskaya Aviatsiya, 28 Mar 59, p 3)

Study on the Effect Geological Conditions on Neutron Flux in the Earth

The problem of studying the neutron flux of the Earth in zones of beryllium deposits was undertaken by V. V. Cherdyntsev and O. V. Suyarova. This was based on the acceptance that the main component of the Earth's neutron flux are neutrons of (α, n) reactions, and the matter generating neutrons for the most part is beryllium. In addition, a comparative study of neutron flux in a laboratory (in the city of Alma Ata, 800 meters above sea level) and in one of the glaciers in the neighborhood of the city (about 3,400 meters above sea level) was conducted.

Thin-layered plates, the emulsions of which were in contact with a saturated (for alpha-radiation) layer of boron carbide (77 percent boron), were used for registering neutrons. The plates were treated with an oxidizer, potassium ferricyanide salts, for eliminating latent

alpha-ray images. The plates were exposed in standard parafin envelopes (one centimeter thick), owing to which the relative number of slow neutrons was somewhat increased. The envelopes were used as shielding against moisture which would cause a regression of the alphaparticles. Calculation showed that for approximately 100 neutrons passing through a plate, one track appeared passing through the boron layer into the emulsion. The sensitivity of the plates proved insufficiently stable, resulting in too great an accumulation of background particles (about three to ten alpha-particles per square centimeter per day). The accuracy of the experiments was not very high. A field radiometer was used for studying the gamma radiation at all points where work was conducted.

It was found that there was no increase of neutron flux in the region of pegmatite beryllium deposits and in nonactive parts of pneumatolytic beryllium deposits. Slow neutrons predominate in the flux, since they enter mainly from the atmosphere, as it is possible to determine through experiments with plates screened with cadmium filters.

A measureable flux of slow electrons was found neither in the glacier or in the laboratory. A considerable increase of neutron flux was found for a part of the beryllium deposit with increased activity. This was obviously caused by two factors: a sufficiently strong flux of alpha particles and the presence of matter capable of generating neutrons.

This point is the only one known in which a strengthening of the terrestrial component of neutron flux can be interpreted in terms of geological conditions. ("Some Data on the Influence of Geological Conditions in the Formation of Neutron Flux on the Earth," by V. V. Cherdyntsev and O. V. Suyarova, Kazakh State University imeni S. M. Kirov, Alma Ata; Moscow, Izvestiya Akademii Nauk SSSR, Seriya Geologicheskaya, No 2, Feb 59, pp 115-119)

Quantitative Treatment of Stellar Scintillation

Although Montini's qualitative explanation of the chromatic scintillation of stars, given more than 100 years ago, is essentially correct, the authors note, no quantitative account of chromatic scintillation has been given up to now. The scintillation is calculated on the basis of the wave equation and the theory of

locally isotropic turbulence. An expression is derived for the correlation coefficient between fluctuations of the logarithm of the amplitude for waves with two different wave lengths. ("On the Chromatic Scintillation of Stars," by V. I. Tatarskiy and L. N. Zhukova, Institute of Physics of the Atmosphere, Academy of Sciences USSR, and Main Astronomical Observatory, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 124, No 3, 21 Jan 59, pp 567-570)

Bolide Seen at Ashkhabad

The observation of a bolide with a magnitude of -4, using binoculars, is described by I. S. Astapovich, Institute of Physics and Geophysics, Academy of Sciences Turkmen SSR in an article in the source. The sighting was made during the meteor observation program on 16 June 1944 at 1938 hours Greenwich time, in Ashkhabad in the park of the Pedinstitut (37 57 N, 58 23 E, altitude 220 meters). (Observation of a Bolide with a -4 Magnitude, With Binoculars," I. S. Astapovich; Ashkhabad, Izvestiya Akademii Nauk Turkmenskoy SSR, No 6, 1958, pp 121-122)

IV. SEISMOLOGY

Absorption of Ultrasonic Waves in Water

Previous developments in the study of the absorption of ultrasonic waves in water are summarized as follows:

"A distortion in the form of ultrasonic waves at relatively low intensities (several watts per square centimeter) was observed in liquids of low viscosity, and it was established that this distortion plays a significant part in the increase in the absorption coefficient of waves of finite amplitude (L. K. Zarembo, V. A. Krasil'nikov, and V. V. Shklovskaya-Kordi, Doklady Akademii Nauk SSSR, Vol 109, 1956, p 485 and p 731). It was then shown that before ultrasonic cavitation begins to play a role, the increase in the absorption coefficient is almost completely due to the distortion of the wave form, and an attempt was made to explain this in terms of the nonexponential character of the absorption (L. K. Zarembo, O Pogloshchenii Ul'trazvukovykh Voln Konechnoy Amplitudy v Zhidkostyakh (On the Absorption of Ultrasonic Waves of Finite Amplitude in Liquids,) dissertation, Moscow, 1958). Finally it was shown that at a frequency of one megacycle and an intensity of 40 watts per square centimeter, an ultrasonic wave which is sinusoidal initially (at the emitter) takes on a saw-shaped form at a distance of about 10 centimeters from the emitter (V. A. Burov, V. A. Krasil'nikov, Doklady Akademii Nauk SSSR, Vol 118, No 5, 1958). Thus, the wave may be considered as a weak periodic shock wave."

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In the article, the behavior of the absorption coefficient at high intensities of the ultrasonic wave, when the wave has this saw-shaped form, is studied in its relation to the frequency of the intensity and distance from the emitter. The absorption of ultrasonic waves was measured in distilled water at room temperature for frequencies of 1, 1.5, and 2 megacycles and intensities of 50-250 watts per square centimeter. ("On the Absorption of Ultrasonic Waves of High Intensity in Water," by V. A. Burov and V. A. Krasil'nikov, Laboratory of Anisotropic Structures, Academy of Sciences USSR, and Moscow State University imeni M. V. Lomonosov; Moscow, Doklady Akademii Nauk SSSR, Vol 124, No 3, 21 Jan 59, pp 571-574)

Study on Volcanic Theory

The occurrence of liquid magmatic beds of the Kluchevskiy Volcano at a depth of about 60 kilometers, i. e., in the boundary between the Earth's crust and mantle, is determined on the basis of their screening effect on direct transverse seismic waves. The size and shape of the magmatic beds, as conceived by the author from observations of the "seismic shadow," are described.

A number of examples are given which it is claimed indicate the possibility of creating a general theory of volcanology, from which, proceeding from the fact of the location of magmatic beds at great depths, a number of basic and particular laws on the manifestation of vulcanism could be generalized. ("Some Problems on the Theory of Volcanology," by G. S. Gorshkov, Laboratory of Volcanology Academy of Sciences USSR, Moscow; Izvestiya Akademii Nauk SSSR, Seriya Geologicheskaya, No 11, Nov 58, pp 21-27)

V. GLACIOLOGY

Electric Methods of Geophysical Prospecting Applied to Glacier Study

The use of electrical methods of geophysical prospecting was made by the Zailiyskiy Glacier Expedition of the Academy of Sciences Kazakh SSR for the detailed study of the moraines of the Maloalmatinskiy glaciers of Zailiyskiy Alatau. This work was conducted according to the IGY program, and is described by B. A. Borovinskiy.

The goals sought in the use of these methods were the determination of the internal structure and the sizes of the moraine formations, the mapping of the boundaries of interred ice, and the portions of old congelation, an explanation of thermal caverns, and also the partial separation of the vertical profile of moraines according to age.

The great difference in the electrical properties of rocks served as the basis for application of electrical prospecting methods.

Moraine formations have the following specific electrical resistances: unfrozen moraine formations from 1,000 to 6,000 ohms per meter; frozen moraines, from 8,000 to 20,000 ohms per meter; buried, contaminated ice, from 20,000 to 50,000 ohms per meter; buried ice with little contamination, up to 200,000 ohms per meter; and bed rock up to 5,000 ohms per meter.

In the frontal moraine of the Molodezhnoye Glacier, the method of the natural electrical field was applied for determining the gradient of filtering waters. This arose from the assumption that this field is created by the electromotive force of the waters being filtered and is not of chemical origin. The latter finds confirmation in visual observations of the region and general theoretical data on the formation of moraines.

The study of the structure and extent of moraine formations was made by setting up vertical electrical soundings and electrical profiling with both the usual electrical symmetrical arrangements, as well as by the establishment of the mean gradient. Two stages in the part of the glacier being studied were singled out, and upper and lower stage with a differential in altitude of about 300 meters. Electrical profiling was conducted on the two stages of the moraine, both along it and across it. This made it possible to outline parts of old congelation and buried ice and also to determine the characteristics of this ice. Sounding gave the possibility of constructing vertical profiles of the moraine. Profiles were made along six lines.

Certain difficulties were encountered in the arrangement of the work, due to the chaotic accumulation of coarse, fragmented material up to 150 meters high on the surface of the moraine formations.

Sounding points were selected on the basis of the possibility of laying the electric cable and establishing good grounds.

Other difficulties, connected with the transportation of equipment, led to the selection of small and light apparatus.

A drawing showing the parts of the moraine in which the buried ice and the old congelation are spread, based on the data of the survey, is shown. It gives the general characteristics of glaciation of this region.

Borovinskiy makes the following conclusions: the western side of the valley is characterized by much weaker glaciation; the buried ice here is more altered and is closer in its parameters to old congelation. Solid monoliths of ice were rarely found. The intensity of solar radiation is much stronger in the first part of the day than in the second part, when, as a rule, cloudiness reaches 70 percent. The eastern part of the valley occupied by the moraine is shaded by the steep mountain side, and, as a result, receives less warmth than the western part. The ice here is less subjected to change. It contains less inclusions of terrigenous materials than the ice of the western part.

The use of geophysical methods, in particular the methods of electrical prospecting, yields new material on the structure of moraines which it would be impossible to obtain by other methods. ("The Investigation of the Moraines of Maloalmatinskiy Glaciers of Zailiyskiy Alatau by Electrical Geophysical Prospecting," by B. A. Borovinskiy; Alma Ata, Vestnik Akademii Nauk Kazakhskoy SSR, No 2, Feb 59, pp 31-37)

VI. ARCTIC AND ANTARCTIC

Volcanic Activity in the Arctic

In June 1958, the drift station Severnyy Polyus-6 obtained interesting information on the Lomonosov range while drifting over it from the southeast to the northwest, between 80 51 and 83 10 N latitude. This was the fourth time that a drift station had crossed this submarine range. During these drifts, it was established that the principal chain of the Lomonosov range is crossed by many transverse breaks and canyons. As a result, relatively isolated peaks and hills have been discovered. Some of them, possibly, were formed in the aftermath of destruction of the range by glaciers and by water at the time when it was above sea level.

One of the most interesting discoveries was the finding of traces of volcanic activity in the Arctic. It appeared that several elevations were clearly of volcanic origin. This was established for the first time by the drift station Severnyy Polyus-3 in November 1954.

It is very likely that some of the earthquakes on the Lomonosov range, which are now being recorded by seismic stations operating at the Arctic observatories on Ostrov Kheysa and Bukhta Tiksi, have a volcanic and not a tectonic character. However, tectonic

earthquakes are no less likely to occur in this area. This is indicated by the numerous transverse breaks of the Lomonosov range -- an obvious sign of the so-called "block" (glybovoy) character of its surface. The vertical displacements of individual blocks in relation to each other cause earthquakes; when they occur at the bottom of the ocean, as in this case, they cause seaquakes.

One (if not several) of the epicenters of earthquakes recorded in the northern part of the Greenland Sea, at a point 79 24 N and 1 30 W. is undoubtedly of volcanic type. Quite recently, an expedition on the Ob' discovered a separate elevation in this area, with 2,065 meters of water above it. Even more important is the fact that within only 5 miles from this point, a volcanic mineral, basalt hornblende, was discovered in the top layer of the bottom soil, corresponding to the present-day silt deposits, as well as in another layer, deposited between 80,000 and 100,000 years ago. It is true that the crystals of this mineral are not numerous and they might have been carried here by ice. This might be assumed, especially since there are obvious traces of a former volcanic activity on Spitsbergen and near the coast of Greenland.

However, if this were so, then why were these crystals deposited only in one place, and, besides, in the layers of different geological periods, while not one of 50 other stations discovered this mineral in the bottom soil?

It seems more plausible to believe that the discovered minerals are the product of volcanic eruptions which took place somewhere in the immediate vicinity. Two other important facts support this theory. In the first place, the underwater eruption in the Greenland Sea, to the west of Spitsbergen, has been mentioned before in literature. In addition, one should keep in mind the seismic activity in this area. The seismic zone extends from the Atlantic Ocean across Iceland, the Jan Mayen Island, and the Greenland Sea into the Arctic Basin and farther on toward the mouth of the Lena River. As it is known, the seismic zones usually coincide with the volcanic zones.

Traces of volcanism in the Arctic Basin were found also on the other side of the Lomonosov range, on one of its parallel spurs. On the basis of data collected by US scientists, it was concluded that the elevations of the ocean bottom, between the parallels 85 15 and 86 15 N and the meridians 83 98 W, are of volcanic origin.

To the southwest and west of these elevations, Soviet expeditions have discovered the same volcanic mineral as mentioned above, i.e., basalt hornblende, in the bottom soil. This mineral is also found on the other side of the basin, near the continental slope bordering the Chukchee Sea from the north.

Thus, the impression is gained that fairly active geological processes continue to develop in the earth's crust of the portion of the Arctic Basin bordering on the Pacific Ocean. This point of view radically changes the prevailing idea that the structure of the ocean botton in this region has been relatively frozen in its geological development. ("IGY in the Arctic -- Volcanoes in the Arctic"; Moscow, Nauka i Zhizn', No 1, Jan 59 pp 24-26)

Artic Research: Upper Atmosphere, Radio Wave Propagation, Long-Distance TV Transmission

Complex observations of the daily and irregular changes in the flow of cosmic rays are being conducted at Ostrov Kheysa. These observations, together with data to be obtained by Sputnik No 3, should provide a great deal of information on the nature of the phenomena which are being studied, especially in connection with solar radio emission, auroras, and geomagnetic disturbances.

Automatic photography, used for the first time in observations of auroras, is of great scientific interest. The spectrum of auroras is photographed and recorded on a film on a 24-hour basis with the help of special instruments, the "S-180" camera and the "S-180s" spectral camera. Special radar installations are also used for observations conducted for the same purpose.

Similar research is conducted by the stations Severnyy Polyus-6 and Severnyy Polyus-7. The Soviet explorers Moiseyev and Belousov have obtained interesting data. On the basis of visual observations, they came to the conclusion that there are two zones of intensive auroras. This confirms the hypothesis expressed by A. P. Nikol'skiy, a well-known explorer of the Arctic. The first of these zones was discovered as early as 1881. The second zone of high intensity and frequency of auroras was discovered recently.

Geophysicists assume that ionospheric disturbances must be intensified in both of these zones. As is known, the auroras and magnetic-ionospheric disturbances have a great effect on the propagation of radio waves. In passing through the field of magnetic-ionospheric disturbances, radio waves are absorbed to a considerable extent, which affects the quality of trans-Arctic radio communications.

The Soviet drift stations have been conducting interesting experiments. It was found that reception of television broadcasts is possible over a distance of 4,000 kilometers. However, these experimental receptions were possible only when the ionosphere, from which the radio waves are reflected at a height of not less than 2,500 kilometers, was calm. When even minor disturbances occurred, the reception was disrupted.

The collection of interesting material under the IGY program continues. It is obvious that, as the result of observations, many more hypotheses will be confirmed, and important conclusions will be drawn which have great significance both for theory and for practical purposes. The new and up-to-date equipment of Soviet scientists opens up wider possibilities for studying not only the nature of our planet, but also of the cosmos. Here lies the deeper meaning of the fruitful international cooperation of scientists, as represented by the IGY. ("IGY in the Arctic -- In the Upper Atmosphere"; Moscow, Nauka i Zhizn', No 1, Jan 59, p 26)

Arctic Ice Reconnaissance

A polar aviation airplane, piloted by S. A. Petrov, left Leningrad for the Arctic on 10 February. A group of scientific associates of the Arctic and Antarctic Scientific Research Institute, headed by A. L. Sokolov, Candidate of Geographical Sciences, was aboard the plane. The scientists will study the ice cover of the Arctic seas.

During a 3-week period, the "ice reconnaissance team" will fly over 30 000 kilometers in difficult weather conditions. ("Reconnaissance of Polar Ice"; Moscow, Sovetskaya Aviatsiya, 11 Feb 59)

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